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ABSTRACT

In fall 1997, the University of Wisconsin-Whitewater (UWW) provided Science and Technology in Society, a university general studies science literacy course, to advanced placement high school students at three local high schools, using a combination of live video presentations and World Wide Web (WWW) courseware. A total of 26 high school students registered for the course. The instructors met the students personally at the beginning of the semester. At this time, they administered a learning style inventory, and a survey covering demographics, reading and television preferences, computer experience, and academic course work and interests. A pretest of course content was also given. Results of a comparison of grade point averages (GPAs) for traditional and distance education sections of the class were as follows: university students, traditional delivery--2.39 GPA; university students, WWW exercises--2.13 GPA; high school students, WWW exercises/on-site lectures--2.69 GPA; high school students, WWW exercises/video lectures--2.20 GPA. It was concluded that the combined audio/visual and WWW delivery of course content to high school students for college credit is an effective teaching strategy, in spite of some barriers due to bugs in TopClass, the selected WWW course delivery system. (DLS)

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Integration of Live Video and WWW Delivery Systems to Teach University Level Science, Technology, and Society in High Schools

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Purpose

We provided Science and Technology in Society, a university general studies course, to advanced placement high school students using a combination of live video presentations and World Wide Web courseware. This gave regional high school students an opportunity to earn three credits toward a required course at the University of Wisconsin-Whitewater (UWW), in one semester of high school without traveling to the university campus. The university, in turn, saw this as an opportunity to recruit high performance students and to possibly slightly reduce student enrollment pressure in the often over-subscribed classrooms used for the Science and Technology in Society course in the following fall semester.

Course Description

Science and Technology in Society (STS) at UWW is a science literacy course rather than a course introducing extensive science content. Required topics covered in STS include science history; art, science, religion and philosophy as world views; pseudoscience; the philosophy of science; ethics of science and technology; science and the media; types of scientific inquiry; experimental design; data analysis; science communication; risk/benefit analysis; and interactions between science, technological development, and the society at large. A typical class is composed of about two thirds freshmen and one third sophomores. Up to 58 students meet twice per week for lecture, then break into groups of up to 29 for one additional discussion session per week. Students must have credit, or be concurrently enrolled, in intermediate algebra. Enrollment in or completion of STS is required before students may take any non-major's science course. There is a similar co-requisite for most major's' science courses, as well. The careful integration of STS shows that the university considers the course content important as a foundation of its science education programs.

Approach

Instructors

The class was taught in tandem by a chemistry instructor who also has extensive training and expertise in personal computer programs and networking (JB) and a biologist (LU). Both

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had helped develop the traditional version of the course, and have taught the course for at least two and one half years before this trial began.

Facilities

The distance education version of the course was taught in the fall semester of 1997. Three local high schools participated, using the Jefferson-Eastern Dane Interactive (JEDI) Network. The JEDI Network uses fiber optics to connect nine southeast Wisconsin school districts and three campuses of the Madison Area Technical College in a live audio/video network. Each site can simultaneously transmit two camera video signals and display up to four incoming video feeds. One camera in each facility is mounted at the back of the room for following the instructor, and another is mounted in the back to send images of the students to the other participating sites, allowing students to interact with each other as well as the instructor. Local and distant cameras can be zoomed and panned with a television-type hand-held remote control. One of the video lines may be redirected to a document camera as necessary. There is a student microphone for every two to four seats, depending on the facility, and a wireless clip-on microphone for use by the instructor or discussion leader. Each JEDI facility also has a facsimile machine and telephone.

The Course

High school student enrollment. The course was advertised to high school students through established publicity mechanisms of the JEDI Network. Registration was restricted to juniors in the top 25% of their class, and to the top 50% of the senior class. Sixteen students enrolled at Whitewater High School, where the lectures originated. Six more registered from Lake Mills High School, twenty miles away. Four students from Johnson Creek High School, 20 miles from Whitewater, but had to drive five miles to Lake Mills twice a week to participate due to a room scheduling conflict at their home institution.

High school data collection and assignments. The instructors met the students from each school personally at the beginning of the semester to introduce themselves and the course goals and objectives. The instructors used the opportunity to distribute a learning style inventory, and a survey covering demographics, reading and television preferences, computer experience, and academic course work and interests. We also gave them a 50 question multiple choice pre-test over course content, encouraging serious effort by offering them one point extra credit on their first exam for each ten questions they answer correctly on the pre-test. The final examination was identical to the pre-test and served as a post-treatment test. It was also given to the students in person. All other course assignments were given, submitted, critiqued, and graded over the World Wide Web, using TopClass version 1.20 (later upgraded to 1.22a), and integrated course presentation package from WBT Systems. It includes an internal E-mail system, announcement and class discussion bulletin board threaded one layer deep, a course lesson area, testing options, and private score reporting functions for each student.

University sections using the WWW. Two sections of the course for university students were taught by the same instructors, using the same organizing overhead transparencies, and using the same survey, testing, and assignment protocols as for the high school students, but in a standard classroom without video equipment. Although discussion sections were scheduled as usual, there was little direct interaction of the students and the faculty during

the discussion periods. Instead, it was used simply as a time when the students were assured fifty minutes of uninterrupted access to campus computers. They could, and often did, elect not to attend and to work on their assignments at their own convenience. Although a note was included in the student timetable flagging these sections as, "experimental course. Requires knowledge of e-mail and World Wide Web for independent work in discussion period," we believe there was little self selection among the students for this section. The high student demand because the course is mandatory and the limited class size creates sufficient enrollment pressure that students likely registered for the section as room and schedules allowed, rather than in response to the timetable notice.

University student control sections. Another three sections were taught identically to the university sections just described, except the discussion sections were conducted as usual. There was extensive interaction between the instructors and the students, and student group work was highly encouraged. Assignments were identical to those in the experimental sections, but were distributed and collected on paper.

Results

Grade Performance

The average grade point averages for each class are shown in Table 1.

Table 1: Class GPA for Traditional and Distance Education Sections

University students, traditional delivery	2.39
University students, WWW exercises	2.13
High school students, WWW exercises/on-site lectures	2.69
High school students, WWW exercises/video lectures	2.20

There appears to be a minor decline in performance among UWW students using WWW for class exercises, as compared to those attending scheduled discussion sections. This may be due to the medium of delivery itself, or because the traditional class room had personal instructor contact and clearer opportunities to work in groups, since they were required to attend discussion sections to receive their assignments. It may also be due to an increased lag time in instructor feed back for the sections using the WWW, since we found there was a very large increase in grading time required in electronic grading to call up documents, type comments, and to compare papers to assure consistency of grading.

There also is an apparent decline in performance between the JEDI (high school) students on-site and off-site. Although small sample size makes its reality questionable, it appeared to the instructors that the off-site students did not focus as well on lecture material during class, without the physical presence of the instructor in the room. Because of the relatively large group of off-site students for the given facilities, at times it was difficult for the instructors to adequately monitor the attention and response of those pupils.

There was not a noticeable difference in performance between the high school students and the more traditional college students. If anything, the JEDI students performed better than their older colleagues. UWW requires successful applicants for admission be in the upper 50% of their class in high school, mirroring the registration criterion we used for seniors in our course. It is unlikely, then, that academic ability of the students differed except by sampling error, although it is possible that there was additional self-selection among the high school students due to the advanced placement status of this course.

Critique of Course Delivery

Successes. Anecdotally, the instructors were pleased with the delivery of the course overall. If possible, they will continue to follow the JEDI student cohort for admission to UWW, as compared to a randomly selected group of students from these schools. The advance college credit may serve to increase the likelihood that these students will attend UWW, and hence may prove a useful recruiting tool to help keep our best students in Wisconsin, as well as a chance to challenge and stimulate these students while enriching their curriculum.

Limitations. The instructors chose to use complex essay, take home questions for a required examination and an optional second final (in addition to a required multiple choice final) in order to limit the impact of student collusion on exams. In comparison to the mix of essay questions with objective questions that they have used in previous semesters, this substantially increases workload and contributes to the inability to quickly provide performance feed back to the students. For this strategy to be implemented routinely in the future, they feel that class size or course load would have to be reduced to improve teacher incentive and grading turnaround time. Alternatively, additional assistance may be recruited from distant sites to allow monitored in-class exams, as is typical for non-distance education classes.

Concerns. The integrity of the study was damaged somewhat due to the inadequacy of the particular WWW distribution vehicle in use. The version of TopClass installed at the start of this course had flaws which manifested in a major systems failure in the third week of class. The technical support provided by the company was inadequate, requiring three full weeks to provide a program patch and to debug the now corrupted database. Although the problems were mostly solved at the end of that period, occasional problems in receiving submitted material continued through the semester, and increased in frequency with time. It was very difficult for instructors to confirm that missing assignments were indeed due to server problems, rather than oversight by the student, meaning that a number of missing assignments had to be excused, without confirmation of student hardship, as would normally be required. In addition, student frustration in completing and submitting their assignments undoubtedly compromised the learning environment and student attitudes toward this approach.

Student attitudes and expectations. In spite of this problem, student comments from the JEDI class proved mostly positive. Two surveys were conducted by Mr. Roger Yin, with short answer questions given the first and the last week of the semester to the students who agreed to participate the research study. The survey questions were designed to assess both students attitudes and technological skill levels. In general, students' initial expectations of the distance learning class were consistently matched with what they think they have learned after the class, except the intermittent TopClass server crashes that interrupted their

discussions or forced them to resubmit their assignments. Regarding computer skills, all participants think the use of World Wide Web as a gateway to communicate with both instructors and peers actually leveraged their ability to apply computer knowledge toward meaningful problem solving and information sharing.

Projections for the future. The infrastructure now in place has the potential to serve as a framework for additional course offerings that incorporate interactive WWW lessons for self directed studies. This could mean courses delivered entirely over the WWW, or for use in tandem with traditional deliveries. For instance, to address the problem of additional faculty burden per student, practice questions could be posted with feed back from the instructor programmed in advance. The instructor response would be customized depending on the correct or incorrect answers submitted by the student. Open class discussion on-line will be enhanced in future versions of TopClass, allowing fully threaded discussion. TopClass or other similar courseware packages may also be used in conjunction with other Internet tools, such as E-mail, Internet Relay Chat (IRC) and bulletin board systems, or WWW simulations thereof, such as HyperNews, previously used with good results by these instructors.

Conclusion

In summary, the combined audio/visual and WWW delivery of course content to high school students for college credit appeared to be an effective teaching strategy, in spite of some barriers due to bugs in the selected WWW course delivery system. Although the approach adopted here for distance learning is more time intensive per student for the faculty as compared to traditional classroom instruction, it can be useful when distant education is a valued part of a university's mission. The technology and infrastructure established by this project is continuing to be used to explore novel delivery systems for course material, seeking to improve student performance in both traditional and nontraditional settings.

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Autobiographical Sketches

Lance Urven received his Ph.D. in Genetics from the University of California, Davis. In addition to courses in general biology, cell biology, animal development, histology, and bioethics, he has taught Science and Technology in Society for three years. In 1994, he hosted the first trial of the Knowledge Project, a distance education project using desktop videoconferencing, sponsored by AT&T, the Coors Foundation and the American Association for the Advancement of Core Courses.

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L. Roger Yin has earned his degree in Instructional Systems Technology at Indiana University with an emphasis on designing and applying multimedia/hypermedia in educational and training settings. In addition to overseeing the operation of the Multimedia Development Center and planning and implementing a series of faculty training workshops on Multimedia topics at University of Wisconsin-Whitewater, Roger also serves on the UWW Web Development Team, and is presently the member-at-large of the UW System Learning Technology Development Council. Roger has made presentations in national and international conferences including EDUCOM, ED-MEDIA, AECT, NECC, and AERA. He co-authored a featured article "Birth of a Proactive Instructional Technology Center: A Case of System Change" which appears in the November, 1995 issue of Technological Horizons in Education (T.H.E.) Journal.

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